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ABSTRACT

The effects of educational stimulation on creative thinking ability and the relationships among verbal and figural creativity, intelligence, and school readiness were investigated in a sample of 123 first grade children. The educational stimulation consisted of special advanced instruction in physical education, music, art, social studies, and mathematics provided in experimental first grade classrooms by professional staff members concerned with the cognitive stimulation of young children. Control subjects were assigned to traditional, self-contained classrooms. Children and teachers were randomly assigned to either control or experimental classrooms. After five weeks of school, a battery of tests including the Torrance Tests of Creative Thinking, the Metropolitan Readiness Test, the California Test of Mental Maturity, and the Picture Interpretation Test was administered. Educational stimulation resulted in significant differences favoring the experimental group for language, total IQ, and picture interpretation. A varimax rotation of the image analysis solution used to explicate the relationships among figural and verbal creative thinking abilities, language and nonlanguage IQ, and reading readiness resulted in the identification of six factors. The results support other analyses which report independent dimensions for creativity and intelligence domains. In addition, figural and verbal subfactors in the creativity domain emerged. (Author/JMB)

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EDUCATIONAL STIMULATION, CREATIVITY, INTELLIGENCE AND SCHOOL READINESS IN YOUNG CHILDREN

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ABSTRACT

The effects of educational stimulation on creative thinking ability and the relationships among verbal and figural creativity, intelligence, and school readiness were investigated in a sample of 123 first grade children. T tests, means, and standard deviations as well as Pearsonian and point biserial correlations are reported. Educational stimulation resulted in significant ($p < .05$) differences favoring an experimental group for language and total IQ and picture interpretation. Results of a varimax rotation of the image analysis solution resulted in six factors: (a) figural creativity, (b) verbal creativity, (c) intelligence/school achievement, (d) picture interpretation and school readiness, (e) educational stimulation and language intelligence, and (f) maleness, nonlanguage intelligence, and spatial/numerical abilities. The results support other analyses which report independent dimensions for creativity and intelligence domains. In addition, figural and verbal subfactors in the creativity domain emerged.

EDUCATIONAL STIMULATION, CREATIVITY, INTELLIGENCE AND SCHOOL READINESS IN YOUNG CHILDREN

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In the past decade a number of preprimary educational programs (Bereiter & Englemann, 1966; Gray et al., 1966; Hamlin et al., 1967; Pines, 1966) were described which departed from more traditional curricula emphasizing play and social activities approaches to school readiness. In general, these approaches explicitly emphasized intellectual development. It was not clear from these studies, however, to what extent children's creative development was facilitated. Torrance (1965, 1967) and Williams (1976), for example, have observed that many children experience a discontinuity in creative growth at about age five and between the third and fourth grades. Efforts to determine if programs of educational stimulation can ameliorate such discontinuities have rarely been reported. One of the first documentations of creative growth associated with an experimental preprimary program was reported by Torrance, Fortson, and Orcutt (1967). Children who experienced the Creative-Aesthetic Approach to School Readiness demonstrated greater creative thinking abilities than peers enrolled in a more traditional preschool program. In a series of related studies Torrance and his associates (Torrance, 1969; Torrance & Phillips, 1969, 1970; Richmond et al., 1972) investigated the effects of a cognitively-structured program of educational stimulation on the creative development of young children. At the first grade level analysis of variance results indicated significant differences for figural originality

($p < .05$) and figural elaboration ($p < .05$) and for verbal fluency ($p < .05$) and verbal originality ($p < .05$) scores from the Torrance Tests of Creative Thinking. Surprisingly, at the second grade level this trend reversed and control subjects were uniformly superior on the figural creativity test while the experimental subjects were superior on the verbal creativity test. At the third grade level experimental subjects were superior on two of the figural creativity scores and two of the verbal creativity scores. In summary, these findings suggest that the cognitive-structured program may have been more facilative of verbal rather than figural modes of creative expression. The verbal creativity scores, for example, revealed a pattern of continuity throughout the first three grades.

Since verbal expression, both oral and written, comprises a large segment of educational programs, the findings of Torrance and his associates may be suggesting that verbal rather than figural modes of expression are more closely associated with school curricula and hence more easily developed. In contrast, figural creative abilities may represent skills which are seldom practiced and which require more specific programs of education stimulation.

METHOD

Subjects

The subjects were 123 white first grade children (53 girls and 70 boys) enrolled in five classrooms in the Lillie E. Suder School in Clayton County, Georgia. The school is located in a middle class residential community near the metropolitan Atlanta area. Fifty of the subjects had experienced one year of cognitive-structured educational stimulation in

an experimental preprimary program under the general supervision and sponsorship of the University of Georgia Research and Development Center in Educational Stimulation. These subjects had been randomly selected from applicants in such a way as to represent a national stratification by sex, socio-economic status, parental educational level, and race of the community. It should be noted, however, that some of these children had attended private kindergartens during the preceding year, and it is not known what type of educational stimulation they had experienced. This would, of course, reduce the chance of advantage for the experimental subjects.

The subjects were randomly assigned to a control or experimental classroom. In the experimental classroom special advanced instruction in physical education, music, art, social studies, and mathematics were provided by a professional staff concerned with the cognitive stimulation of young children. Classroom activities encouraged divergent thinking skills in the content areas.[1] In the control classrooms subjects were assigned to traditional, self-contained classrooms. All teachers were randomly assigned to either the experimental or control classrooms. Subjects in the experimental classrooms were taught by five teachers throughout the day. Each teacher represented one of the cognitively structured content areas. Subjects in the control classrooms were taught by one teacher. Control-teachers were given no instruction regarding their teaching activities.

Test Measures and Procedures

After five weeks of school, Figural Form A of the Torrance Tests of Creative Thinking was administered in classroom groups and Verbal Form A of this battery was administered orally and individually by a research

team under the supervision of Dr. E. Paul Torrance. In addition, all children were administered the Metropolitan Readiness Tests (Form A), the California Test of Mental Maturity (Revised, 1963), and the Picture Interpretation Test (Torrance & Grossman, 1967). Information concerning the first four tests is available in numerous sources. The Picture Interpretation Test was developed to measure a child's ability to "read a picture." The child is presented with a novel stimulus picture and is asked to agree or disagree to questions concerning the content of the picture (Aliotti, 1970).

It was hypothesized that no differences would be obtained between the experimental and control children on measures of creativity, intelligence, and school readiness.

Experimental Analysis

To determine the effects of the educational stimulation on the performances of these children a series of t tests comparing the test performance of the experimental and control children was computed on a subset of the total sample which contained complete data. Significant differences in favor of the experimental group were obtained for CTMM Language IQ ($\bar{X}_E$ = 115.30, SD = 23.85 vs. $\bar{X}_C$ = 105.34, SD = 18.58; $t_{(81)} = 2.13$, $p < .05$), CTMM Total IQ ($\bar{X}_E$ = 115.03, SD = 18.55, $\bar{X}_C$ = 106.40, SD = 16.77; $t_{(81)} = 2.20$, $p < .05$), and Picture Interpretation ($\bar{X}_E$ = 7.91, SD = 2.14 vs. $\bar{X}_C$ = 6.92, SD = 1.76; $t_{(81)} = 2.30$, $p < .05$).

Among male first grade children significant differences favoring the experimental subjects were obtained for Picture Interpretation ($\bar{X}_E$ = 8.28, SD = 2.19 vs. $\bar{X}_C$ = 6.26, SD = 6.26; $t_{(35)} = 3.03$, $p < .01$) and Word Discrimination ($\bar{X}_E$ = 26.56, SD = 6.46 vs. $\bar{X}_C$ = 21.58, SD = 7.56; $t_{(35)} = 2.15$,

$p < .05$). Among female first grade children significant differences favoring the experimental subjects were obtained for CTMM Language IQ ($\bar{X}_E = 118.6$, SD = 14.44 vs. $\bar{X}_C = 105.48$, SD = 2.97; $t_{(44)} = 2.63$, $p < .01$) and Listening ($\bar{X}_E = 11.73$, SD = 2.71 vs. $\bar{X}_C = 10.23$, SD = 2.09; $t_{(44)} = 2.08$, $p < .05$).

Correlational Analysis

A total of twenty measures was obtained and intercorrelated. To facilitate the statistical analysis mean values were inserted for missing data in the following frequencies; figural creativity tests (5), verbal creativity tests (8), and Picture Interpretation tests (22).

Table I presents means, standard deviations and the correlation matrix for 18 variables of creative thinking abilities; intelligence, reading readiness and picture interpretation. Point biserial coefficients of correlation are reported for the sex and educational stimulation variables.

INSERT TABLE I ABOUT HERE

Inspection of the point biserial coefficients of correlation revealed two primary patterns. First, verbal creative abilities tended to be marginally associated with males. The correlations with Verbal Fluency, Verbal Flexibility, and Verbal Originality were .18, .18, and .20 respectively. Only the last correlation was significant, however ($p < .05$). Secondly, Educational Stimulation was significantly correlated ($p < .05$) with several measures of reading readiness, Language and Total Intelligence, and Picture Interpretation. These correlations ranged between .23 (Matching, Alphabet; $p < .05$) and .32 (Language Intelligence; $p < .01$).

Inspection of the Pearson product-moment coefficients of correlation indicated a number of patterns. Figural creativity scores were highly intracorrelated (.80, .75, .71, .50, .47, .44) and showed significant low correlation with intelligence measures ($p < .05$), particularly for CCTM language and CTMM Total I.Q. The highest correlation were between Figural Fluency and Total I.Q. (.36), Figural Fluency and Language I.Q. (.33), and Figural Elaboration and Language I.Q. (.25).

Verbal creativity scores, although highly intracorrelated (.76, .72, .64; $p < .01$), showed very low positive and negative correlations with the remaining variables. The correlations ranged from -.10 to .24 with a median of .00. In addition, the Picture Interpretation score was significantly correlated with Verbal Flexibility (.24, $p < .05$).

Finally, reading readiness scores showed moderate and significant correlations (mean $r = .29$) with the figural creativity scores (.05, $p < .01$). Twenty-three of the 28 correlations were significant at the .01 level of significance. The correlations ranged from .11 to .45 with only four of the 28 coefficients of correlation falling below the .05 level of significance. The total score of the Metropolitan Readiness Tests correlated .45, .34, .34, and .36 with Figural Fluency, Figural Flexibility, Figural Originality and Figural Elaboration, respectively ($p < .01$).

Image Analysis Solution

To further explicate the relationships among figural and verbal creative thinking abilities, language and nonlanguage I.Q., and reading readiness, an image solution was computed after Harris (1962).[2] A previous varimax solution with a smaller subset of the present sample (i.e.,

complete data) and some additional achievement measures resulted in a four-factor solution (Aliotti & Blanton, 1969). Inspection of the oblique rotated factor patterns revealed verbal creativity as a distinct and independent factor. Moderate variance overlap was found among the figural creativity, intelligence, achievement and reading readiness measures. The present image analysis solution provided a more sensitive and conservative test of the previous analysis. Table 2 presents the rotated varimax factor for the image analysis solution.

INSERT TABLE 2 ABOUT HERE

Factor I was identified by a remarkable clear cluster of the figural creativity measure. High loadings were obtained for Figural Fluency (.87), Figural Flexibility (.84), Figural Originality (.82) and Figural Elaboration (.55).

Similarly, factor II emerged as a distinct and separate dimension of the verbal creativity measure defined by Verbal Fluency (.76) and Verbal Flexibility (.75) and Verbal Originality (.74).

Factor III was most meaningfully defined as some dimension of intelligence and achievement as typically measured by tests administered to first grade children. Each measure of intelligence and reading readiness was represented in this factor with the highest coefficients for Copying (.90), Language Intelligence (.84), Nonlanguage Intelligence (.71), Numbers (.67), and Alphabet (.65).

Factor IV was mixed with moderate coefficients for Picture Interpretation (.52), Word Meaning (.46), Numbers (.32), and Alphabet (.20).

Factor V was bi-polar and represented by a moderate coefficient for Educational Stimulation (.54) and a small coefficient for Language Intelligence (.20).

Finally factor VI was identified by small coefficients for males (.39), Nonlanguage Intelligence (.24), Copying (.21), Verbal Fluency (.20), and Numbers (-.20).

DISCUSSION

The separation of the figural and verbal creativity factors in the present study tends to support previous analyses. Bee (1962) obtained little across content congruency among verbal, numerical, and spatial subtests of divergent thinking in a sample of fifth-grade children. Richards (1976) obtained factor separations for general intelligence, mechanical ability, general creativity, and creative uniqueness. Hollingsworth (1965), reported that figural creativity in sixth grade children did not stand out as a functional unit; rather, two independent traits were identified: the ability to deal with complexity and the ability to take an unfinished structure and complete it. Nevertheless, creativity and intelligence were independent. Hetrick et al. (1968) conducted a replication and extension of the Hollingsworth study. Again, utilizing subjects from the fourth through the sixth grades, figural creativity did not stand out as a functional unit, but rather as a combination of "distinguishable" traits; the ability to complete the unfinished (divergent production of figural implications); the ability to handle complexity (production of figural systems); and preference for complexity. In addition, Hetrick et al. (1968) found traditional measures of intelligence and grades to be independent of the figural creativity measures.

The clarity of the figural and verbal creativity factors would seem to lend support to the rationale for developing both figural and verbal forms of creativity tests (Wallach & Kogan, 1965; Torrance, 1966).

Surprisingly, the verbal creativity factor failed to correlate to any degree with any of the intelligence, school readiness or figural creativity factors. At higher grade levels, low to moderate coefficients of correlation have been reported between measures of verbal creativity and academic achievement and intelligence (e.g., Ripple & May, 1962; Yamamoto, 1965). Torrance (1973), however, reviewed approximately 300 reports, abstracts, and journal reprints which employed his creative thinking battery and found the median of 65 correlations between creativity measures and standardized achievement measures to be .28. A comparable review of 88 coefficients of correlations between measures of intelligence and verbal creativity resulted in a median correlation of .21. A perusal of the research literature would tend to corroborate Torrance's findings.

Educational stimulation was clearly related to the readiness and verbal intelligence measures ($.05 < p < .01$). However, only the verbal originality score was significantly correlated with education stimulation ($p < .05$).

While participation in the program of educational stimulation was associated with superior performances in creativity tests (Torrance & Phillips, 1970), the present data suggests that the preprimary program of educational stimulation may have been more facilitative of traditional school achievement than creative thinking abilities.

Table 1

Intercorrelation Matrix of Creative Thinking Ability, Intelligence, and Reading Readiness Scores for First Grade Children
N = 123

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	X	SD
1	Sex																					.57	.49
2	Educational Stimulation	-06	-																			.40	.49
3	Figural Fluency	-05	-03																			40.05	7.89
4	Figural Flexibility	00	-14	80																		43.15	9.23
5	Figural Originality	-12	11	75	71																	39.63	7.31
6	Figural Elaboration	-08	15	52	44	37																45.44	10.49
7	Verbal Fluency	18	-09	21	14	12	16															35.33	6.67
8	Verbal Flexibility	18	-03	19	11	10	15	76														34.39	7.92
9	Verbal Originality	20	-05	23	15	19	12	72	64													34.49	5.97
10	Word Meaning	02	25	28	18	11	27	02	00	-02												8.93	2.64
11	Listening	-01	29	23	12	24	16	00	02	-05	41											10.59	2.56
12	Matching	-09	23	33	22	30	33	04	08	01	40	26										7.54	3.25
13	Alphabet	-18	23	44	34	30	30	-03	00	-02	34	38	54									1.62	4.81
14	Numbers	-06	18	37	29	26	31	11	10	02	56	60	55	71								12.15	4.73
15	Copying	-13	05	26	33	30	35	-01	03	-04	46	62	54	54	55							6.31	3.51
16	Total MRT	-12	26	45	34	34	36	09	12	05	70	60	74	82	87	73						55.63	16.09
17	Language Intelligence	04	32	33	21	23	25	-03	10	-03	49	46	45	38	51	37	55					108.47	20.57
18	Nonlanguage Intelligence	02	00	24	22	10	09	-07	-04	00	25	25	31	30	36	27	40	40	-			107.28	17.30
19	Total Intelligence	-01	27	36	26	22	25	-10	00	-04	45	44	42	45	55	43	65	77	51	-		109.79	17.69
20	Picture Interpretation	02	24	04	-08	-12	14	18	24	14	22	15	11	11	18	12	15	05	05	19		7.11	1.69

r ≥ .20 significant at .05 level
r ≥ .26 significant at .01 level

CODE: TTCT - Torrance Tests of Creative Thinking
MRT - Metropolitan Reading Readiness Test
CTMM - California Test of Mental Maturity
PI - Picture Interpretation Test

NOTE: Decimals have been omitted.

Table 2

Varimax Rotated Factor Matrix *
(Image Analysis Solution)

Variable	Rotated Factor Loadings I	II	III	IV	V	VI
Sex	-	-	-	-	-	39
Educational Stimulation	-	-	-	-	54	--
Figural Fluency	87	-	-	-	-	-
Figural Flexibility	84	-	-	-	-	-
Figural Originality	82	-	-	-	-	-
Figural Elaboration	55	-	-	-	-	-
Verbal Fluency	-	76	-	-	-	20
Verbal Flexibility	-	75	-	-	-	-
Verbal Originality	-	74	-	-	-	-
Word Meaning	-	-	37	46	-	-
Listening	-	-	57	-	-	-
Matching	-	-	58	-	-	-
Alphabet	-	-	65	20	-	-
Numbers	-	-	67	32	-	-20
Copying	-	-	90	-	-	21
Language Intelligence	-	-	84	-	20	-
Nonlanguage Intelligence	-	-	71	-	-	24
Picture Interpretation	-	-	-	52	-	-

* Decimals have been omitted.

NOTE: Coefficients < .20 have been omitted.

NOTES

1. The educational stimulation was typical of "structured-cognitive" programs described by Bissell (1973). Teachers directed educational activities rather than responding to informal learning opportunities provided by children. Objectives were oriented toward the development of aptitudes and activities related to learning processes. A heavy emphasis was placed on basic classroom subject matter. Experimental subjects received special advanced instruction on physical education, art, music, social studies, and mathematics.

2. Interdependent scores from the TTCT (e.g., fluency and originality) were retained for the factor analyses. Although there is experimental dependence among the figural and verbal scores of the TTCT no acceptable means was available to overcome this difficulty. Pruzek and Phieffer (1974), however, have reported that the image analysis solution used in the present study does not violate the necessary assumptions for this analysis.

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